
| RESEARCH ARTICLE

Refinement and Validation of Research Instrument for Assessing Executive Functioning Skills in the Post-Pandemic Education: The MEASURE Approach

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| ABSTRACT

This paper describes the development and validation of an instrument for measuring and assessing the executive functioning skills of learners with special educational needs towards academic achievement. Based on the comprehensive review of related literature and thorough study of the researcher, the instrument was carefully constructed and examined among learners with special educational needs (N=26). The data was randomly divided into 5 variables (organization, planning, time-management, self-control, and metacognition). A preliminary study of the 26 non-respondents in the questionnaire produced a Cronbach alpha value of 0.820 (Organization), 0.852 (Planning), 0.896 (Time-Management), 0.885 (Self-Control), 0.814 (Metacognition) to test the internal consistency and reliability of the questionnaire. The results show that 5 variables could be distinguished as reliable and have a credible construct with a dependability score of at least 0.80. Thus, the results regarding the validity of the instrument were acceptable.

| KEYWORDS

Executive functioning skills, special education, measure approach, instrument validation.

| ARTICLE INFORMATION

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1. Introduction

In the aftermath of the pandemic, ensuring educational continuity for learners with special educational needs remains a pressing priority in both remote and traditional learning environments. Despite the challenges brought forth by the global health crisis, schools are steadfast in their commitment to providing high-quality education aimed at bolstering the essential skills required for daily life (So et al., 2023). Executive functional skills, encompassing abilities such as organization, planning, and effective task execution, continue to exert a profound influence on both academic achievement and personal development (Brandt, 2020). These skills, cultivated through educational experiences and study habits, play a pivotal role in fostering comprehensive growth (Alam & Mohanty, 2023). They are indispensable for academic success, personal advancement, and the cultivation of independent living skills crucial for navigating the post-pandemic landscape and overcoming the academic challenges it presents. The researchers opted to investigate these functional skills with the aim of facilitating interventions and support for learners with special educational needs, thereby ensuring continuity in their learning amidst the factors influencing post-pandemic education. This study enables tailored assistance based on the individual's level of disability and the challenges encountered in enhancing their functional skills. In examining the executive functional skills among learners with special educational needs, the focus is on crafting a research questionnaire aimed at assessing the impact of executive functioning skills on both academic and personal progress. This questionnaire aims to pinpoint the specific functional skills requiring early intervention for daily life and to illuminate the challenges posed by the pandemic in developing essential skills for independent living. The researcher selected and adapted executive functioning skills deemed most pertinent to the study's objectives. Subsequently, the researcher tailored the checklist to gather data pertinent to the research objectives, incorporating localized functional skills aligned with academic and personal goals.

Lastly, thorough attention was spent to ensure the relevance to learners with Individualized Education Programs (IEP) in classroom settings, with input from special education teachers informing the adaptation and modification of questionnaire items.

2. Literature Review

The challenge remains prevalent as numerous learners with special educational needs conclude their high school education without attaining proficiency in fundamental academic skills despite their crucial significance in navigating various challenges encountered in different spheres of life. This delay can be attributed to the limited development of cognitive skills and the relatively low levels of executive functioning skills (Jansen et al., 2021). The development of executive functions not only varies among individuals but also within individuals, as evidenced by research highlighting wide disparities in executive development (D'Intino, 2023). Executive functions play a pivotal role in adapting to new environmental stimuli, particularly when such adaptations necessitate the development of new behaviors for success (Pasqualotto et al., 2021). Consequently, these skills are integral to the holistic well-being—encompassing academic, personal, psychological, and social domains—of students with special educational needs. Given their significant impact on academic achievement, executive functioning has become increasingly pertinent to the progress of students, particularly those with special educational needs (Villaver & Justiniane, 2023).

The challenges faced by students with special needs in engaging in academic-related activities often manifest across multiple domains, including organization, planning, metacognition, and self-control (Stan, 2021). Consequently, executive functions underlie the difficulties and struggles experienced by these learners across various academic disciplines. Executive Functions serve to regulate and direct students' behaviors towards purposeful actions (Gunten et al., 2020). Adolescents encountering difficulties with Executive Functions may struggle with shifting attention between activities or demonstrating impulsivity by acting without forethought. Consequently, Executive Functions wield significant influence over adolescents' mathematics learning experiences. Within the mathematics classroom, adolescents may experience a range of emotions such as worry, hopelessness, guilt, boredom, rage, enjoyment, or pride. It is crucial to acknowledge these emotions as they exert a profound impact on adolescent learning outcomes and overall well-being (Pekrun, 2022).

Achieving success in both academic and professional settings often hinges upon the levels of organization and self-regulation exhibited by individuals. Indeed, these skills are not only commonplace but essential for thriving in various occupations. Preparing students for postsecondary education, whether through vocational training, pursuing undergraduate studies at a four-year university, or engaging in graduate education, necessitates the cultivation of such skills (Battaglino, 2022). As noted by Weigers (2017), these deficits in executive functioning can manifest in various challenges related to learning, organization, working memory, and classroom behavior. These challenges may include difficulty in learning fundamental skills such as reading, struggles with organizational tasks such as losing assignments, issues with working memory resulting in trouble remembering and following multi-step directions, and difficulties in maintaining appropriate classroom behavior such as restlessness and inattention.

The symptoms associated with deficits in executive functioning include challenges with time management, frequent absences, and tardiness to classes, meetings, and work commitments (Hakkinen et al., 2021). Consequently, strong organization skills play a crucial role in fostering effective study habits essential for academic success. Moreover, organization skills significantly impact the study habits of learners with special educational needs, presenting a navigational challenge for these students (Hansen et al., 2022). It is observed that students with special needs often experience a decline in organizational skills, attention deficits, and self-regulatory challenges, which may persist from adolescence into adulthood. These difficulties can manifest in struggles with basic organization, such as maintaining orderly backpacks and keeping homework and assignments organized, as well as difficulty in setting short-term goals and establishing effective study habits. Addressing these challenges may necessitate targeted interventions and support aimed at enhancing executive functioning skills.

3. Methodology

In this research, the researcher utilized the MEASURE approach as described and conducted by Kalkbrenner and Gormley (2021) to develop and validate instruments that served as a guide through the process. This approach is appropriate for this study and anchored on social science. The approach taken in designing and validating an instrument directly impacts the accuracy and effectiveness of the measurements. By evaluating using the MEASURE approach, the researcher can assess the instrument's ability to truly capture the diverse range of executive functioning skills of learners with special needs. In this research, there are latent variables (executive functioning) that need to be assessed, and this is a suitable approach because of its practicality in the development and validation. In this approach, we can use or apply the existing measures in evaluating existing research tools or instruments with the respondents. In the first step, the researcher defines the purpose and seeks the intended skills to measure, wherein the variables and indicators should reflect what is intended to be assessed and evaluated. Secondly, the research instrument undergoes a substantive stage, which tests the researcher to study the variables within the context of the theoretical framework. Thirdly, the researcher began to refine and organize the empirical framework by creating a theoretical blueprint. Fourthly, the researcher establishes the parameters of the proposed construct to ensure and avoid redundancy. In the next process,

the instrument was sent to a group of expert reviewers who were knowledgeable in the field of special education. After a review has been done, pilot testing (N=26) is performed on non-respondents. Lastly, initially validating a score to measure its validity (the scale of measuring what is intended to measure) and reliability (consistency of scores) as the evidence of the measure, variables, and indicators.

The figure below summarizes the steps to answer the research questions tailored beforehand. Each step is discussed, and the subsections on participant characteristics, sampling, psychometric properties of the instrument used, the procedure and the design used are embedded.

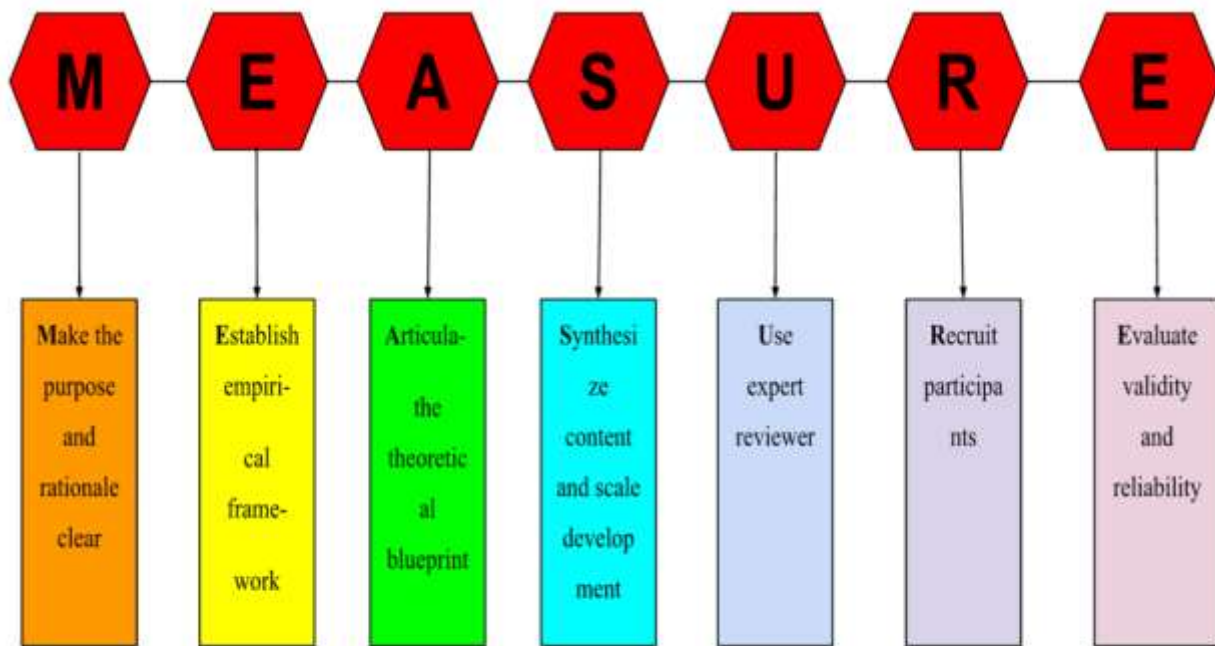


Figure 1. The MEASURE Approach of Instrument Development

3.1 Make the purpose and rationale clear.

In the initial phase of an instrument development study, researchers articulate the objective of the study by delineating the variables they intend to evaluate and elucidating the significance of the study (DeVellis, 2017; Dimitrov, 2014). In this research, the aim is to assess the executive functioning skills of learners with special educational needs amidst the COVID-19 pandemic. During this preliminary stage, the researcher conducts a comprehensive review of existing literature pertaining to the proposed construct of the instrument on executive functioning. The primary objective is to ascertain whether an existing measure can be adapted or if modifications are necessary to align with the specific skills exhibited by the respondents. Throughout this process, the researcher meticulously evaluates the rigor of the instrument by comparing the methodologies employed by previous researchers to establish empirical standards. Additionally, the researcher identifies similar instruments utilized in previous studies and identifies any gaps in the existing literature. This critical assessment aids in refining the instrument development process and ensures the validity and reliability of the assessment tool.

3.2 Establish Empirical Framework

This involves the systematic establishment of a theoretical and methodological framework for the development of the measurement instrument. The researcher develops a context of a theoretical framework (Kalkbrenner, 2021). Researchers identify the theories and/or synthesized findings from the existing literature to set a practical framework for the item development process. This research is anchored on the Functional Context Theory of Sticht and the Functionalist Theory of Durkheim. This study will also be utilizing the Social Learning Theory of Bandura, the Education, Science and Technology, Arts, Culture, and Sports, Section I of Article XIV of the 1987 Philippine Constitution (Republic Act No. 10533), also known as the Enhanced Basic Education Act enacted on 2013, the Magna Carta of Disabled Persons otherwise known as Republic Act No. 7277, the Policy Guidelines on the Adoption of the K to 12 Transition Curriculum Frameworks for Learners with Disabilities (DepEd Order no. 21 s. 2020) and the Adoption of the Basic Education Learning Continuity Plan for School Year 2020-2021 in the Light of the COVID-19 Public Health Emergency which will serve as the legal backbones of the study (DepEd Order no. 12 series of 2020).

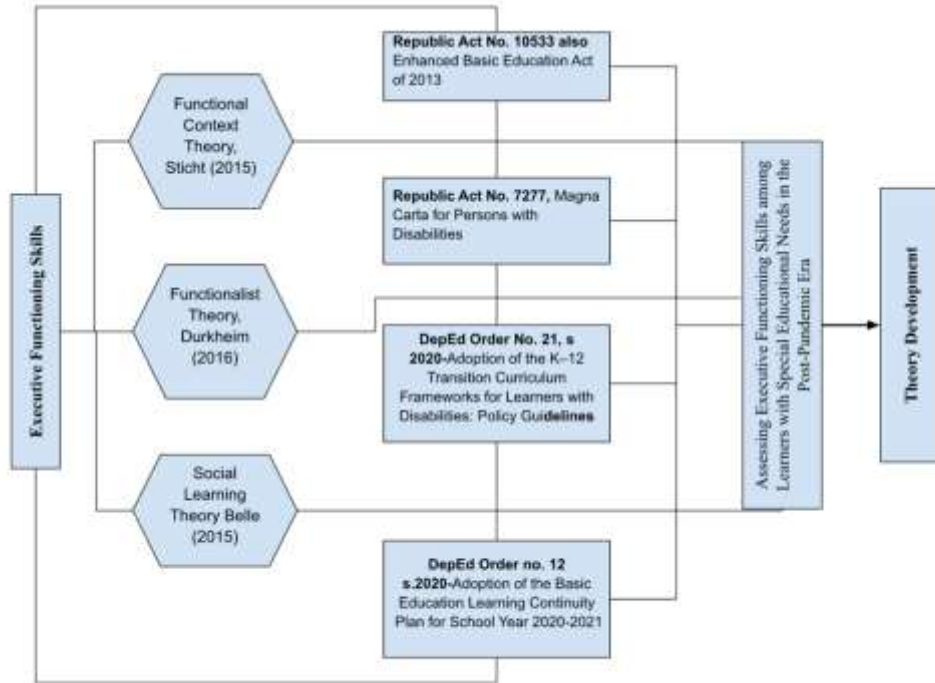


Figure 2. Theoretical Framework of the Study

3.3 Articulate Theoretical Blueprint

In this stage, researchers must begin to refine and structure the framework to enhance the content validity and determine the appropriate items developed for the research. A theoretical blueprint (figure 2) is a tool for enhancing the content validity of a measure by offering the researchers two primary advantages, including creating the content and domain areas for the construct of measurement and determining the approximate proportion of items that should be developed across each content and domain area.

Executive Functioning Skills of Learners with Special Needs		Domain Areas
		Frequency (No. of indicators)
Content Areas (Variables)	Organization	6
	Planning	5
	Time-Management	5
	Self-control	5
	Metacognition	5

Figure 3: Theoretical blueprint on Executive Functioning Skills

3.4 Synthesize Content and Scale Development

In this process, researchers separately compile a long list of potential items (variables and its indicators). Then, researchers can get together for a meeting or meetings to review, contrast, and discuss until a conclusion is reached over the pool of items that will be sent to the expert reviewers (school psychologists, counselors, and co-spced teachers). The executive functioning skills assess the following skills, namely, organization, planning, time-management, self-control, and metacognition.

3.4.1 Scaling

The five-point Likert Scale, as shown below, was applied to categorically rate the executive functioning skills of learners with special educational needs.

Weight	Range	Interpretation	Description
5	4.23 – 5.00	Highly Skilled	The child has extensive experience in the functional skill area
4	3.43 - 4.22	Moderately skilled	The child has good experience in the functional skill area
3	2.62 – 3.42	Averagely Skilled	The child has average experience in the functional skill area
2	1.81 – 2.61	Low-averagely Skilled	The child has little experience in the functional skill area
1	1.00 – 1.80	Unskilled	The child has no experience in the functional skill area

Figure 4: Schematic representation of Likert Scale

3.5 Use of Expert Reviewers

After the discussion of items, researchers have a total of three outside subject matter experts who are handed the initial pool of items for examination. Reviewers are typically either (a) survey/questionnaire specialists who are educated about psychometrics and the mechanics of item generation or (b) substantive/subject matter specialists who have in-depth knowledge of the subject matter. Hence, in this study of special education, the reviewers are (1) SPED Teacher, (1) Researcher, and (1) Research Coordinator, who is included in the team to review the instruments.

Reviewer's Initials	Age	Gender	Educational Attainment	Research Background
Ri La	36	M	Doctor of Education (DevED)	Researcher/Research Adviser
Vi Ma	35	M	Master of Arts in Education (MaED)	Research Coordinator
Jo De	38	F	Doctor of Education (SPED)	Researcher/SPED Teacher

Figure 5: Profile of Expert Reviewers

3.6 Recruit Participants

3.6.1 Pilot Testing

Before the collection of data, the researchers administered the test to a small pilot sample that closely resembles the target demographic non-respondent’s special education students and then examined the test results for data imputation and technological problems as well as participant comments on item readability and content. Then, start gathering data for the primary study by choosing whichever of the following criteria results in a larger sample: 100 participants or (a) a subjects-to-variables ratio of roughly 10:1. (Considering the small number of students with IEP in the school’s division of Toledo City). The researcher submitted a letter of permission to conduct and to gather research data through the Schools Division Superintendent of Toledo City Division addressed to special education institutions, namely, South City Central School, Bato Elementary School, Matabang Elementary School, Magdugo Elementary School, DAS Elementary School. Though it was the former station where the researcher taught, the school head’s permission was particularly important. Consequently, a letter asking for the parent’s consent to conduct this study will also be sent. The researchers conducted a questionnaire through a Google form. Due to the limited access to face-to-face interaction, the research adapted the data gathering procedures online. Researchers sent a Google link to all respondents, and respondents, through the guidance of their teachers and parents, must complete the Executive Functional Skills Questionnaire.

3.7 Evaluate Validity and Reliability

The final step is initially testing the validity (the scale measures what it is intended to measure) and reliability (consistency of scores) of the evidence of scores on the measure and its subscales using IBM SPSS software. In this research, Cronbach Alpha, thru IBM SPSS, appropriately presents, describes, evaluates, and infers the acquired data from the respondents via survey questionnaires.

Reliability Evidence (Cronbach's Coefficient Alpha). Cronbach's alpha was used to analyze the survey's items' internal consistency. A preliminary study of the 26 items in the questionnaire produced a Cronbach alpha value of 0.820 (Organization), 0.852 (Planning), 0.896 (Time-Management), 0.885 (Self-Control), and 0.814 (Metacognition). According to Hair (2009), a credible construct should have a dependability score of at least 0.70 to be accepted. Thus, the total reliability analysis result for this study was acceptable and demonstrated the reliability of the questionnaire's items. Lastly, if these previous steps show robust results, the instrument is finalized. Replication of the steps can be done until the finalization of the new instrument.

4. Results and Discussion

To address the research objectives, researchers employed standard multiple linear regression analysis. Preliminary examination indicated that assumptions regarding normality, linearity, and multicollinearity were upheld. This model was utilized to investigate the extent to which various executive functioning skills, including organization, planning, time-management, self-control, and metacognition, influence learners' academic success. On the collinearity data, all tolerance values were greater than 0.10, and variance inflation factor (VIF) values less than ten suggested there were no issues with multi-collinearity when using multiple linear regression. The preliminary study was done to make sure the multi-collinearity was not violated, and strongly correlated data between independent variables of 0.90 and higher confirmed this (Pallant, 2020). Based on the results, a correlation study revealed that the levels of positive linear correlation between the independent variables were significantly low to moderate. The findings revealed that all variables related to students' executive functioning skills, including organization, planning, time-management, self-control, and metacognition, were statistically significant ($p < 0.05$) predictors of students' proficiency in executive functioning. Moreover, the proficiency level of students' executive functioning development exhibited a strong association with all variables. This suggests that students' proficiency in executive functioning aids them in monitoring their academic progress, adapting their thinking, managing working memory, regulating themselves, and organizing their tasks, particularly in the context of distance learning. Among these variables, student organization skills demonstrated the highest standardized coefficient (Beta = 0.748), indicating its greatest importance in determining the effectiveness of embedding executive functions in academic tasks for student achievement. This underscores the pivotal role of organization skills in facilitating students' engagement in the learning process and overcoming challenges in a self-directed learning environment. The unstandardized coefficients further elucidate the precise contributions of each variable to the regression model used in the investigation.

5. Conclusion

Amidst the challenges posed by the COVID-19 pandemic, there arises a need to develop an instrument for assessing executive functions in students with special educational needs, considering the disparities in their academic performance. A research questionnaire proves to be the most straightforward method for evaluating their abilities for independent living and academic success post-pandemic. This study focuses on examining executive functioning skills such as organization, planning, time management, self-control, and metacognition as variables. By addressing these functional skills, the research aims to provide intervention and support tailored to the varying levels of disability and difficulty experienced by learners with special educational needs, thereby ensuring continuity in their learning during the post-pandemic. The overarching goal of this research instrument is to empower learners with special educational needs to cultivate self-sufficiency and independence. Despite their conditions, it is essential for these learners to strive for maximum independence, particularly as they transition into the workforce. By emphasizing these skills, the study aims to identify and address the needs and gaps of learners with special educational needs, ultimately enhancing their executive functioning skills and enabling them to function effectively and independently within their community's post-pandemic. While this study on assessing executive functions in students with special educational needs during the post-pandemic provides valuable insights, it is not without limitations. The sample size and diversity might be restricted, potentially hindering the generalizability of the findings. Furthermore, the effectiveness and validity of the research questionnaire as an assessment tool may not have been extensively validated, raising concerns about the accuracy of the results. The study's static approach to the evolving pandemic situation and potential self-report biases among participants could limit the relevance and precision of the interventions proposed. Future researchers should consider conducting longitudinal studies with larger and more diverse samples, validating assessment instruments rigorously, and incorporating objective measures to enhance the reliability of findings. Additionally, the development of dynamic interventions, collaboration with stakeholders, and exploration of other influencing factors can contribute to the practical application and broader impact of the study's outcomes. Ultimately, future research should address these limitations, explore unanswered questions, and pave the way for tailored, inclusive support programs to empower students with special educational needs effectively.

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References

- [1] Alam, A., & Mohanty, A. (2023). *Does Musically Responsive School Curriculum Enhance Reasoning Abilities and Helps in Cognitive Development of School Students?* In CRC Press eBooks (pp. 337–341). <https://doi.org/10.1201/9781003457619-66>
- [2] Battaglino, K. L. (2022). *Supporting Postsecondary Transitions: An Instrumental Case Study Exploring College and Career Readiness through the Lens of Educational Stakeholders* (Doctoral dissertation, Concordia University Wisconsin).
- [3] Brandt, W. C. (2020, March 31). *Measuring Student Success Skills: A Review of the Literature on Self-Directed Learning. 21st Century Success Skills*. <https://eric.ed.gov/?id=ED607782>
- [4] Dimitrov, D. (2012). *Statistical methods for validation of assessment scale data in counseling and related fields*. Google Books. <https://books.google.com/books>
- [5] Devellis, R. (2017). *Scale development: Theory and Applications*. <https://search.worldcat.org/title/scale-development-theory-and-applications/oclc/931226867>
- [6] D'Intino, J. (2023). *Evaluating the rationale and evidence supporting executive functions skills instruction in the classroom: A critical review*. *Psychology in the Schools*, 60(4), 1125-1148.
- [7] Gunten, C. D., Bartholow, B. D., & Martins, J. S. (2020). *Inhibition tasks are not associated with a variety of behaviors in college students*. *European Journal of Personality*, 34(3), 412-430.
- [8] Häkkinen, J., Ihantola, P., Luukkainen, M., Leinonen, A., & Leinonen, J. (2021, August). *Persistence of Time Management Behavior of Students and Its Relationship with Performance in Software Projects*. In *Proceedings of the 17th ACM Conference on International Computing Education Research* (pp. 92-100).
- [9] Hair, J. F. (2009). *Multivariate data analysis*. Digital Commons @ Kennesaw State University. <https://digitalcommons.kennesaw.edu/facpubs/2925/>
- [10] Hansen, L. K., Ellis, B. M., & Smith, S. D. (2022). *A Transdiagnostic Approach to Develop Organization, Attention and Learning Skills: The GOALS Treatment Manual for College Students*. Taylor & Francis.
- [11] Hinger, C. (2023). *Development of the Racial Allyship Characteristics Scale: Measuring White Allyship from the Perspective of People of Color*.
- [12] Jansen, L., van Steenis, A., van den Berg-Huysmans, A. A., Wiggers-de Bruine, S. T., Rijken, M., de Vries, L. S., ... & Steggerda, S. J. (2021). *Associations between neonatal magnetic resonance imaging and short-and long-term neurodevelopmental outcomes in a longitudinal cohort of very preterm children*. *The Journal of pediatrics*, 234, 46-53.
- [13] Kalkbrenner, M. T. (2021). *A practical guide to instrument development and score validation in the social sciences: The MEASURE Approach*. *Practical Assessment, Research, and Evaluation*, 26(1), 1.
- [14] Pallant, J. (2020). *SPSS survival manual: A step by step guide to data analysis using IBM SPSS*. McGraw-hill Education (UK).
- [15] Pasqualotto, A., Mazzoni, N., Bentenuto, A., Mule, A., Benso, F., & Venuti, P. (2021). *Effects of cognitive training programs on executive function in children and adolescents with autism spectrum disorder: A systematic review*. *Brain sciences*, 11(10), 1280.
- [16] Pekrun, R. (2022). *Development of Achievement Emotions*. *The Oxford Handbook of Emotional Development*, 446.
- [17] So, H. J., Jang, H., & Kim, M. (2023). *Trends and Issues of Digital Learning in Korea*. *Trends and Issues of Promoting Digital Learning in High-Digital-Competitiveness Countries: Country Reports and International Comparison*.
- [18] Stan, M. M. (2021, September). *Self-Management Skills and Student Achievement—A Pilot Study*. In *ATEE 2020-Winter Conference*. Teacher Education for Promoting Well-Being in School. Suceava, 2020 (pp. 490-506). Editura Lumen, Asociatia Lumen.
- [19] Villaver, M., & Justiniane, L. B. (2023). *Challenges of English Language Learners towards Remote Independent Study: Developing a Theory*. *Journal of Learning and Development Studies*, 3(1), 52-61.
- [20] Wieggers, E. (2022). *The Impact of Stimulant Medication on the Relation between Working Memory and Activity Level in ADHD* (Doctoral dissertation, Saint Louis University).